Interak CP/M Detailed Description and Implementation Instructions

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D M Parkins, Greenbank Electronics, 92 New Chester Road,
New Ferry, Merseyside. L62 5AG Tel: 051-645 3391

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The current version of CP/M supplied for Interak is version 2.2. Both the Interak system and this implementation of CP/M have been arranged to allow considerably more choice to the user than is usual in such systems. Much of the work on this implementation was carried out by Mr Wolfgang Schroeder sadly who died in February 1986. He did much work on the disk monitor/boot EPROM, and several other programs which are supplied on the diskette. He devised a unique technique to enable us to supply a small set of standard versions which nevertheless can be set up by the user himself to suit a far wider range of requirements.

The Interak CP/M is supplied to the customer on a diskette suitable for one of the following formats, (in each case a sector is 512 bytes):

*3.5"	1D	(One-sided Double Density)	40 tracks	10 sectors/track
3.5"	1D	(One-sided Double Density)	80 tracks	10 sectors/track
*5.25"	1D	(One-sided Double Density)	35-40 tracks	10 sectors/track
5.25"	1D	(One-sided Double Density)	80 tracks	10 sectors/track
*5.25"	1D	(One-sided Double Density)	77-80 tracks	15 sectors/track
8"	1D	(One-sided Double Density)	77 tracks	15 sectors/track

*These increasingly unpopular formats will only be available if there is sufficient demand.

Preferred format, (the "Interak 1" standard disk size and format):

3.5"	1D	(One-sided Double Density)	80 tracks	10 sectors/track

(The reason that a single diskette will suit a 35-40 track drive, and similarly the 5.25 inch 77-80 track 15 sector "pseudo 8 inch" drive, is that all of the programs and files are located on the outermost (lowest numbered) tracks of the diskette we send you, therefore it does not matter how many subsequent tracks there are.)

The Interak diskette has a system in a special form. It is a form which is certain to require modification by the user, since it uses only the most minimal hardware. Initially it is a single disk drive system (since not all users will have more than one disk drive to begin with) and calls up from the DMON EPROM the routines it needs to read the keyboard and write to the screen. There are at present 3 types of DMON EPROM, and the appropriate one of these must be located on the CPU card in the EPROM position known as the "Boot PROM". The types of DMON are as follows:

DMON-M This is the most common type for Interak use. It is to suit a memory-mapped VDU of 24 rows of 64 columns, eg the VDU-2K (or the VDU-K modified to this format) located at addresses F000-F5FF hex. (hexadecimal), and a parallel ASCII keyboard interface, eg the LKP-1 card, at Port 40 hex., the lower seven bits represent the ASCII data, and the highest bit is a logical "1" when the data is valid.

The VDU driver in this program (and later in the BIOS in CP/M) is capable of making the screen appear like a serial terminal. The control codes (sometimes called "escape sequences") have been chosen to be as close to a standard VDU terminal as possible, the terminal chosen being the

ADM-3A. This of course makes it much easier to use those programs which demand such behaviour of the VDU.

DMON-S This is suit the most professional type of system. It is for a combined serial VDU and keyboard "terminal" having 24 rows of at least 80 characters. The status port (defined bit positions of which the software tests before sending a character to the screen, or reading one from the keyboard) is Port 00, and the serial data port (input from the keyboard, output to the screen) is Port 01. This would generally be a serial interface card, usually for the RS-232 signal levels defined for such purposes.

DMON-H This is a hybrid between DMON-M and DMON-S. The keyboard is as for DMON-M (eg the normal Interak LKP-1 ASCII keyboard interface), and the VDU is as for DMON-S. Although it is not a VDU supported explicitly by the Interak system, we believe the third party "Intelgraph" card can be set up at Port 00 (status) and Port 01 (data) to behave like a serial text VDU. How well it does this depends on how well its driving software has been written, which is of course entirely outside the present authors' control.

There is a point which should be mentioned regarding the use of the present (LKP-1) parallel keyboard interface. It was designed so that it occupied just one port in the system, and expecting the software to take both the data, and the indication that these data were valid, in one single input (read) instruction. CP/M was designed with slower, serial, communications in mind, where the technique is that a status bit is tested by one routine, and an entirely separate routine reads the data. The difference may appear to you to be so subtle that it is irrelevant to the finished performance of the system, however there are certain programs which run under CP/M which work far better with the serial arrangement. An example of such a program is "Wordstar", which is clever enough to appear capable of doing several things at once, for example printing one document while editing another. It does this by checking the keyboard status very regularly, noting when a key has been pressed, and then acting on that key at its leisure. This is not so easy with the present LKP-1 interface, since its single-port design demands that both status and data must be taken at once, and the action of reading the port automatically clears all bits to zero, ready for a new character. If the LKP-1 is in use, and if its characteristics when working with CP/M do become a problem, it is possible to alter either the hardware or the software, (or both). However I feel that it is best to leave such performance "tweaking" until after the system is up and running - it definately works without any modifications, so I suggest getting it running first and fine tune it later if you wish, after you have some experience with it.

The Interak CP/M diskette supplied to you at first uses routines from the DMON EPROM and it therefore will take on the characteristics of whichever DMON you use. Thus it doesn't matter if you have a memory-mapped system, or a serial system, or a hybrid, the CP/M diskette we supply will operate to suit your system.

A consequence of this method is that the EPROM on the CPU card (which later will be switched out automatically) must for the time being remain in the memory map. This is of no additional hardship to begin with because in any event the CP/M on the disk supplied by us is constrained to run within the confines of just 20K of RAM, the minimum size for CP/M Version 2.2

The procedure you should follow will be described in detail as these notes continue, but in essence it is as follows:

1. Make an immediate copy (or copies) of the master disk supplied, put the master disk in a place of safety, and thenceforth use a copy for all that follows. Data can not be copied on to a disk which does not have the correct "format", so it will generally be necessary to use the program called "FORMAT" (which is included on the disk we supply) as part of this procedure. Full step by step details will be provided later in this document.

2. Run a program called "CONFIG.COM" (= "Configuration") on the disk. As it runs you will be able to select (in a very easy way, just by making selections from a menu) the various parameters which define your specific system, eg whether it is serial or memory mapped, at which port the printer is located, whether or not you want a directory when the system is first booted, the number and type of disk drives (up to 4 drives, of 1 or 2 different types, diameters, single or double sided, and so on). The selections you make are used by the CONFIG program to alter another important program on the disk called "MOVCPM.COM", which is why you must work with a copy!

3. MOVCPM.COM is altered in such a way that when it is run (after configuration is completed) it will produce a modified CP/M system having all of the attributes you specified during the previous CONFIG program dialogue. When you run MOVCPM, you can (and often must) specify what size system (ie in terms of RAM in 4K increments from 20K to 64K) you want. In the system produced when MOVCPM is run the DMON EPROM is switched out so that it no longer causes any restriction; in a serial system 64K is a normal size, but in a memory-mapped system where addresses F000 hex and above are used for the Video RAM area, 60K is the maximum for CP/M. There are numerous occasions where a smaller CP/M system is desirable (eg when using a memory-mapped EPROM programmer or EPROM memory card) and this can be the user's choice.

   Note: Experienced users, and those who have been studying books on CP/M will be shaking their heads in amazement, since the CONFIG and MOVCPM procedures described above are utterly different from what is normal in CP/M systems. The standard CP/M distribution disk from Digital Research does not have a CONFIG program or anything like it, and their MOVCPM program is quite incapable of allowing the easy change of RAM size for anybody else's system but their own. The CONFIG program has been written by Wolf Schroeder, who has also carried out the enhancements to MOVCPM. However the CP/M supplied and modified by CONFIG and MOVCPM bears the original Digital Research serial numbers, and all of the licencing restrictions must still be followed, as set out at tedious length in Digital Research's own

documentation.

4. After MOVCPM has done its job, the new CP/M system, set up to meet your own specific requirements, is held in memory ready to be placed on the tracks on the disk which have been reserved for the purpose. This operation is carried out by a program called SYSGEN. Again the version on our disk owes more to the late Mr Schroeder than Digital Research. Particular enhancements are that it is suitable without modification for all sizes of disk, and because in this implementation of CP/M the systems tracks are always recorded as single sided regardless of whether the rest of the disk is single or double sided, it can be used for both single and double sided disks. (A further feature is that on other occasions you can provide a file name when invoking SYSGEN, eg "SYSGEN CPMXX.COM" and a systems track can therefore be laid down directly, according to the contents of the named file, "CPMXX.COM" in this example.)

Once you have made a CP/M system to suit yourself, you can take further copies from the disk you have made; you only have to go through the CONFIG procedure again when you want to make some fundamental change to the system.

Normally systems with less than 2 disk drives are too tedious to have any practical value (although to judge from the popularity of single drive systems in the home computer market there are those who think otherwise), but in this implementation we have added a refinement which makes a single drive system a lot more useful than it would otherwise be. The refinement, which all users will witness since the CP/M disk we supply is set up for a single drive system until you change it, is that 2 logical drives are allowed even if only one physical drive exists. At each stage where the other drive would have been used a message appears on the screen such as "Mount Disk B", or "Mount Disk A". You will need to suffer from schizophrenia (or be willing to obtain it) to get used to the idea of 2 diskettes in one disk drive, but it does enable some practical use to be made of a single drive system, indeed to do things which otherwise would be impossible.

It should also be stressed, in case it is not yet obvious, that mixed drive systems are easily engineered. For example you can have an 8" drive connected and operating in a system which is otherwise 3.5", or vice versa, or many other combinations of size and single or double sided. A restriction is that there is space in this BIOS to accommodate only two different types of drive at a time. (This limitation was accepted to avoid making an excessively "oversize" CP/M, which would reduce the usefulness of CP/M to the majority, while benefitting only a minority.) Of course if the idea of a mixed system appeals to you do be aware that although the standard Interak floppy disk card provides for such use, and this implementation of CP/M provides for such use, the disk drive manufacturers may not. In particular, some thought is needed when mixing the 34-way cables of the smaller drives with the 50-way of the 8" size, not least when ensuring each line gets the appropriate resistive termination network. There is nothing insuperably difficult, but care must be taken. Ideas and suggestions on this topic will no doubt be the subject of articles in the "Interaktion" User Group Newsletter if there is sufficient interest.

You do not have an entirely free hand when running different formats in the same system. One severe restriction in the present implementation is that if a program is run on a double sided disk and returns to a single sided disk there is a fair chance that the system will "crash" - this is because the system may make a futile attempt at getting valid information from the second side of a single sided disk, thinking that it is on the first side, which is of course all it knows.

Most users will work generally with either exclusively single sided or exclusively double sided disks, and only mix the number of sides in use when converting data between single and double sided formats. There is no problem to this - the problem mentioned only applies when running programs in such a system, when there is the occasional danger of being stranded on the "non-existent" second side of a single sided diskette.

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A list of the files normally provided on the CP/M diskette we supply is given next. So that they may be checked more easily we have tried to arrange them on the disk in alphabetical order (which is a feat in itself) and they are listed here in the same order. They fall into a number of different categories: (1) Exactly as supplied by Digital Research, (2) as (1) but with minor published "bug" fixes made, (3) Same name and similar function as Digital Research's originals, but with major enhancements, and (4) Entirely separate programs, which were provided by the courtesy of Mr Wolfgang Schroeder for the unique benefit of Interak system users. There might in the future be minor variations in the names and quantity of files provided but the present count comprises 29 files: 11 in category (1), 3 in category (2), 3 in category (3) and 12 in category (4).

Alphabetical list of files on the Interak CP/M disk

ASM.COM

This is an assembler for 8080 style mnemonics, but of course since the 8080 and the Z80 have so much in common, the object code produced by ASM is suitable for use in Z80 systems such as Interak.

ASM.COM is part of the suite of programs provided in the CP/M package by Digital Research. This version has some minor published bugs fixed. The CP/M documentation supplied by Digital Research includes full details of its use. It is not a highly sophisticated assembler, (naturally better ones are available at extra cost!) but perfectly capable of doing all you need to start with - that is if you are willing to work with 8080 style ("Intel") mnemonics.

Its main use initially to Interak users is to assemble source files already provided on the disk. (Source files are marked with the file extension ".ASM"). It is simple enough to set in motion, for example to assemble a file called "DEMO.ASM" (an imaginary name) you type:

ASM DEMO<cr> ("<cr>" means carriage return)

This will produce a number of files (see Digital Research's documentation for full details), amongst which will be one called in

this example DEMO.HEX. This can be made into a ".COM" file which can be run as a "transient" program (again you will have to study the copious CP/M documentation for full details and definitions) by the use of another program on the disk called LOAD.COM; see under "LOAD.COM" below for a continuation of this saga.

BIOS.ASM

This is a source listing provided by Digital Research of the BIOS they themselves supply. It is of limited use to Interak users because (a) it is only for single density 8" sytems, and (b) it is intended for a particular 8080 development system manufactured by the firm Intel, who do things in ways which have very little in common with the ways of the Interak system.

CBIOS.ASM

This is another source listing provided by Digital Research, as an aid to those dedicated souls who are writing their own customised BIOS, "CBIOS" for short. It is like the BIOS listing above but gives only the basic elements of what is necessary, so that the user can follow them to get a very simple CP/M implementation running to aid his further experiments. The Interak CP/M already has its own CBIOS so Digital Research's CBIOS will be of little more than passing interest.

(There are of course areas in the Interak CP/M implementation which will be of great interest to Interak users, either to observe or to modify for their own particular. All the parts which can be examined and/or modified by the user have been gathered together in one convenient area, the source listing of which is given as a file on this disk called "USER.ASM". Most users will be able to carry out all the modifications they require by the simple use of the program "CONFIG.COM" which makes the alterations to the appropriate locations automatically.)

CONFIG.COM

This is not a Digital Research product. It is used to alter the special "MOVCPM.COM" on the disk to allow the user to configure and reconfigure his system in a wide variety of different ways. The program is started by typing CONFIG<cr>.

COPYDISK.COM

This is another extra, not provided by Digital Research. It is used for copying entire disks, often for the purposes of making a "backup". This can also be done by using one of the many features of the Digital Research "Peripheral Interchange Program", PIP.COM, but COPYDISK is much quicker. It has some restrictions, which are indicated when the program first signs on, and you should be aware that the use of COPYDISK will overwrite all the information on the destination disk, so you must only use it in those circumstances where this is what you want to happen.

Start this program by typing COPYDISK<cr>. I am not certain at the moment whether you should answer the question the program asks as to how many tracks are to be copied with the number of tracks on the

disk or the number of tracks on the disk minus 1.

COPYFILE.COM

This is yet another non-Digital Research program, used to copy a single file from one disk to another. Start this by typing eg COPYFILE EXAMPLE.FIL<cr> if "EXAMPLE.FIL" is the name of the file you wish to copy.

CPM20.COM

Digital Research include a file of this name on their own CP/M disk, but of course it is a copy of their own implementation. The file on the Interak CP/M disk contains instead a copy of the Interak CP/M implementation. It is the initial one supplied for use in a 20K system, assuming a DMON monitor/boot and a single disk drive. You should not overwrite it unless you want to discard it. (It is therefore recommended that you keep this file safe on the original disk supplied and conduct all experiments on a copy of the disk supplied.)

It should be mentioned, since it is a point which confuses most people new to CP/M, that the CPM20.COM file is not a program which can be run because it only contains the program in a form which can be loaded into a convenient area of memory, and the area into which it is loaded is an area in which it cannot possibly be run. (It would in fact usually be inconvenient if it did replace the version of CP/M which was actually running at the time, because CPM20.COM is not always the version you want to run - rather it is one you are experimenting with.)

After it has been loading into this special area of memory (starting at 0900 hex to be specific) the SYSGEN program is able to write it on to the reserved "systems" tracks of a disk specified by the user. When that disk is booted up the appropriate parts of the systems track are copied into the correct place in memory so that then it will run. As there are elements of which came first the chicken or the egg here, you will be relieved to know that on the Interak CP/M disk we supply the system tracks already carry the appropriate code so that it is a problem you do not have to work out how to solve for yourself.

Once you have the CP/M system working in the way you want it you can save it in a file of your own called CPMXX.COM (where convention has it that "XX" is the size of the system in kilobytes), but easier than that is to use the SYSGEN program to transfer the systems tracks from one disk, via memory, to another.

A final note is that this file is 40 "pages" (of 256 bytes per page) long. This is longer than the size referred to in most descriptions of the CP/M system. You will probably guess that this is because our version is slightly larger, which is why needs the extra space.

For example if a standard CP/M instruction book tells you that you type "SAVE 38 CPM20.COM" to save this file you should in fact type "SAVE 40 CPM20.COM" in our system.

CPMMAP.COM

You will have gathered that this implementation allows you to change the size of your CP/M system with only a fraction of the normal effort. You should not perform this party piece too often because you will end up with lots of different systems on your various disks. (The danger is that you may press the normal "control-C" to warm boot when you change disks and the system will crash: you can't be working with one size system and warm boot to another, you must cold boot in such circumstances. I am very sorry if this sounds like so much gobbledegook to you at your present stage of understanding, but I don't want to get too far off the subject by going into too much detail on the warm and cold boot topic. The Digital Research manuals supplied with CP/M describe these terms more fully.)

So in short, don't overdo the re-sizing of CP/M. However on the occasions you do, you may want to know the addresses of certain key locations in the system, which of course may change as the system size changes. You can calculate their new addresses yourself but this program saves you the work. Just type CPMMAP<cr>.

Needless to say this program is again not one which is provided by Digital Research, it only comes with the Interak CP/M.

DDT.COM

This is the standard Digital Research "Dynamic Debugging Tool", unmodified in any way. It is meant to be a joke that "DDT kills bugs"; with this level of humour it is easy to believe that Digital Research's company name was originally "Intergalactic Digital Research". You can see that facetiousness and flippancy is not confined to Interak alone, although we are trying to stamp it out and be more sensible in future.

DDT is a very useful program, described fully in the Digital Research (non Intergalactic) CP/M documentation. One important use is for it to load files (usually only programs, which have file extensions ".COM" and ".HEX") into memory where they can be altered, and which after exiting DDT can be saved. To save an area of memory as a disk file you use the in-built command "SAVE", with some parameters. Details of this will be found in the Digital Research CP/M description.

DEBLOCK.ASM

This is an exactly as supplied by Digital Research on their own CP/M standard disk. "Deblocking" is necessary whenever the size of the physical sectors on the diskette has been chosen to be greater than the standard 128-byte logical sector which CP/M uses, often this occurs when double density recording is used, since larger sectors often give performance benefits which outweigh the inconvenience of having to get involved in deblocking. In the Interak system each sector on the disk is 512 bytes, which is enough space for 4 CP/M sectors of 128 bytes each.

Double density data transfer rates are exactly twice as fast as those for corresponding single density, but the double density system does not achieve this level of increase in performance. This is because

the increase in speed is offset by the need to look after the other 128 byte logical sectors within the 512 byte physical sectors on the disk. It is impossible to read or write a fraction of a physical sector on a disk, and the "deblocking algorithm" developed by Digital Research takes on the responsibility of handling these matters without reducing the system performance too much.

It is discussed in their CP/M implementation notes (supplied to all purchasers of CP/M as part of the standard documentation) and the present file DEBLOCK.ASM has the source code of an essential part of the necessary routines.

Unfortunately both Digital Research's discussion and the DEBLOCK.ASM file leave quite something to be desired, and the implementation of deblocking is a matter which is best left to an expert if it is to be done correctly. Fortunately we did have such an expert in the person of Mr W Schroeder, so users of the Interak CP/M need do no more worrying on that score since deblocking in our system is already taken care of.

DISKDEF.LIB

This is another Digital Research file which is supplied here without modification. It is of use to people who are writing their own CBIOS and who use different disk formats from time to time. It is easiest if the parts of the CBIOS which change when the type of disks are changed can be defined and redefined in a regular way by using "macros" (ie defined groups of source code) and this file gives the form of these. The DISKDEF.LIB file has little or no relevance to the majority of Interak CPM users, since the common types of disk can be specified automatically when the CONFIG program is run, and more detail is given in the USER.ASM source listing provided as a file on the disk.

DISKMAP.COM

This is not a Digital Research program. When run (by typing "DISKMAP<cr>"), it provides a chart of 0's and 1's which show which areas on the disk are available, and which have been allocated for use. There is no practical benefit to the casual user in discovering this information, but it of use to those who are interested in studying the system in greater depth.

DUMP.ASM

This is as supplied by Digital Research and is the source listing of a program which will allow a user to view and/or print in hexadecimal form the contents of a disk file. This source could be assembled using ASM and loaded using LOAD (qv), but there is no need to do this because the program is also supplied as a ".COM" file ready to run.

One important purpose of providing this utility is as a model for the user so that he can see the methods used to handle disk files under the CP/M operating system.

DUMP.COM

This is the object code of the program described immediately above,

in its executable form. To run it type "DUMP ANY.FIL", where "ANY.FIL" is the name of any file on the disk which you want to dump in this form.

ED.COM

This is another of Digital Research's offerings, being a line by line text editor. I find it a tedious program to use and much prefer a full on-screen editor such as Wordstar, but if you have no alternative you will find ED.COM better than nothing (but only just!) It is described in its tortuous detail in the standard Digital Research CP/M documentation. The basic use of the editor is to originate and edit the source files which are acted upon by the ASM assembler.

FORMAT.COM

This is a vital program, which cannot be part of the standard suite of CP/M programs as supplied by Digital Research, since it depends very heavily for its operation on the floppy disk controller hardware in use (ie the FDC card of the Interak system). A number of options can be entered by the user by making appropriate responses to a question and answer session which begins the operation of the FORMAT program, but a number of default values are provided (displayed in square brackets after each question); you can accept the default values by pressing carriage return instead of giving an answer.

It is always necessary to "format" a blank diskette before it can be used. In some cases this is done by the diskette manufacturer, but rare and in most cases it must be carried out by the user.

Start the program by typing FORMAT<cr>, and remember that you can leave the program if you make a mistake by pressing control-C. There is only one error message in the first version of the program, phrased in such a way that it will be found confusing. (For example if you try to format a write protected diskette you get the message "excessive drive speed", but later versions of this program will be more explicit.)

The process of formatting writes information on each side, track and sector of the disk indicating exactly which side, track and sector it is, and fills each sector with dummy data (the hex. byte "E5" is used, which has been chosen for some technical reason which I forget.) The identification information is never written to again, unless the formatting process is repeated; it is only the data in the sectors themselves, plus a few check bytes, which are written and read by the CP/M disk operating system.

Some of the answers to the questions will seem a little odd in certain circumstances, because of the pace of developments in floppy disk drives; for example it is regular that 3.5" disk drives behave like 5.25" drives and therefore it is appropriate to tell the formatter program that you have 5.25" when in fact you have 3.5". Similarly if you have the very special 5.25" drives which have been designed to rotate and transfer data at the higher rates normally associated with 8" drives you must tell the program that you have 8"

drives even though you haven't.

A brief discussion of the appropriate answers to make to each question follows:

"Drive Number (A B C or D)?" Unless you only have one disk drive, you will try to avoid answering A to this question, as the A drive invariably will used for your CP/M disk - as the formatting procedure destroys any data which was on the disk before it was formatted the use of the A drive is potentially the most accident prone drive for formatting. Naturally you should not answer B C or D unless you do actually have those named drives installed in your system. B

"Single or double density (S or D)?" Double density is the format employed for all normal use in the Interak system, but there are a few occasions when you might need to use single density. I can think of only one such occasion, that of 8" operation where the original IBM 3740 standard ("1S": single sided, single density 77 track 128 bytes per sector) is still used to transfer programs from one system to another, and it is vital then that you can produce disks formatted to this universal standard. Regrettably no such standard exists for the smaller sizes, and the use of single density is therefore of no practical value for anything other than 8". D

"Single or double sided (S or D)?" This depends entirely on the disk drive and diskettes used. The precise format selected for Interak is such that the first side (Side "0") of a double sided disk is exactly the same as the equivalent single sided disk, so it is perfectly allowable for you to format double sided diskettes as such, even if for the time being they are to be used for single sided working. D

"5 1/4 or 8 inch disk (5 or 8)?" Normally answer 8 for 8" drives and 5 for all other sizes, however in those rare circumstances where a drive is masquerading as some other size (eg those special 5.25" drives which are as fast and record as densely as an 8" type) you may have to give an answer other than the obvious one. 5

"First track to be formatted?" You don't have to start formatting at the first (outermost) track on the disk, for example you might like to leave the tracks which carry the systems tracks undisturbed, but in general you will start at the first track, and answer this question accordingly. Note that the first track is track number 0, not track number 1. 0

"Last track to be formatted?" Again you can choose to stop formatting at any track before the end, eg if this time you wished to format only the systems tracks on the disk leaving the data tracks undisturbed, but in general you will answer this question with the number of the actual last track on the disk. Notice that the number you give will be one less than the total number of tracks on one side of the disk since they are counted starting from 0, ie the figures you should enter for disks with 35, 40, 77, 80 tracks are 34, 39, 76, 79 respectively. 79

Because the first and last tracks to be formatted can be specified

independently you could successfully format a disk with a mixture of formats, eg single density systems tracks and double density data tracks. Note that this is not normal procedure!

"Write compensation after track?" It is usually beneficial to apply write precompensation on the inner tracks of a diskette recorded in double density. (This is nearly always true even if the manufacturer of the disk drive boasts that his drives do not need it. Usually disk drive manufacturers own up to the need for precompensation when supplying 8" drives, since they are addressing a more mature audience, but find it better commercially to keep quiet about the subject for the smaller sizes, even though if anything the data is often more tightly packed on the smaller diskettes.)

As the Interak FDC-1 is able to provide preset write precompensation to both sizes of disks when operating in double density, we recommend that you give the following answer to the precompensation question, according to the number of tracks on the disk. If the disk has 35, 40, 77, 80 tracks you should ask for precompensation at tracks 20, 20, 43, 43 respectively.

The skew factor has to be specified for those modern systems which alter the sequence in which the sectors are laid down on the disk, in order to optimise the time it takes to read logically adjacent (ie not physically adjacent) sectors. Interak is such a modern system and therefore you should specify a skew factor in order to get the best performance from the system. With this method, specifying the wrong factor only makes the system run slower, it does not render the data unreadable.

On older systems, particularly those using the original 8" single sided single density IBM 3740 format, the sectors were not skewed physically on the disk; instead a translation table was held in the BIOS part of CP/M, which ensured that data for particular numbered sectors went to differently numbered sectors on the disk, and vice versa when reading the disk. The skew introduced by the table translation was 6, and has remained fixed, (since any change would render all previous disks unreadable), but this is no longer optimum because a fast Z80 can certainly work more quickly than the slow 8080 which was in vogue when the original skew was set. Note that in this old method there is no skewing on the disk, it all takes place in the translation table and therefore the answer to the Skew Factor question in the formatter program is 1, although an answer of 0 has the same effect.

The skew factor to be used in the double density Interak implementation of CP/M can be optimised by the user. Simply choose the factor which gives the quickest results when carrying out the sort of work which is typical of that for which you use the computer. To help you decide on a skew factor a further program called "SPEEDTST.COM" is provided on the disk. Until you try this out I suggest you give the following answers to the "Skew Factor" question:

Single sided single density 128 byte per sector IBM standard 3740 8" diskettes: Skew Factor 1. Double density 8" diskettes: Skew Factor

3. Double density 5.25" and 3.5" diskettes: Skew Factor 2. (I have not specified anything for single density on the smaller size of diskette because, except for special purposes, eg reading other systems' diskettes, it is pointless to use single density; for the special purposes the skew will depend on the purpose.)

Finally, ensure that you have only a blank diskette, or other one you want to format, in the specified drive and press carriage return. Dots appear on the screen as the head moves over initial tracks which are not to be formatted (if any) and then as each track is formatted and verified an asterisk will be printed on the screen. The procedure will either carry on to a successful conclusion, or stop prematurely in the case of difficulty. If a particular diskette is persistently difficult to format discard it. If a particular drive is persistently bad fix it or discard it.

On a successful conclusion you can select the option to run again, exit, or set new parameters. If you choose to exit, replace your system disk in drive A if you have removed it, before exiting from the FORMAT program.

LOAD.COM

This is a Digital Research Program which allows a file with the extension ".HEX" (such as is produced by the assembler program ASM when it is run) to be loaded as a ".COM" file so that it can be run.

".HEX" files contain the program with address information, all in 7-bit ASCII form, for example a program byte 01001011 ("4B" in hexadecimal notation) is represented as the two bytes 00110100,01000010 within a ".HEX" file because 00110100,01000010 is 34,42 in hexadecimal, and 34,42 are in turn the ASCII codes for the number "4" and the letter "B" respectively. ASCII representation of hex numbers in this way is often to be preferred since there are many means for transmitting and recording data in such a form (eg modems, printers, etc). (I shall not be surprised if you find my explanation of this matter causes more confusion than the original question.)

It is only necessary to load a ".HEX" file once because LOAD automatically makes a ".COM" file which can then be used as often as you like.

For example if you had assembled a source file "DUMP.ASM" the hex. file "DUMP.HEX" produced as part of that process can be loaded by typing LOAD DUMP<cr>. This need be done only once, as DUMP will then also exist as "DUMP.COM".

MEMMAP.COM

This is not a Digital Research Program. Typing MEMMAP<cr> will start this program which will determine which areas are RAM is in a particular system. Areas where EPROM is present, or indeed no memory at all are indicated. This is useful if you are working with a system with "holes" in the RAM areas for some special purpose (eg a memory mapped EPROM programmer, or other EPROM card); CP/M must be used with great care in such a system if an unexplained "crash" is to be avoided. In the general Interak system RAM will be present troughout

the memory map, so the result of running this program will be rather boring.

MOVCPM.COM

Although this is a program normally provided by Digital Research, this version has been enlarged and extensively modified. It now works in the way Digital Research originally intended, but which is not possible with their own version in any other system other than their specified Intel development system. In particular the warnings in the Digital Research documentation that the use of MOVCPM results in the production of a CP/M with the wrong BIOS can now be ignored. In the Interak version the use of MOVCPM produces a CP/M which has the correct BIOS.

The warnings given about serial numbers, copyright restrictions etc., however do still apply, as the CP/M produced by MOVCPM still is Digital Research's.

Use MOVCPM in the way described in Digital Research's manual, and note also that the CP/M produced is larger than the original and now occupies 40 "pages" (where a "page" here is 256 bytes).

PIP.COM

This is the Digital Research program, but with any published minor bugs fixed.

PRINT.COM

This is another non-Digital Research program. It is used to allow simultaneous printing and other use of the computer. It is simple enough to use but you should be aware that the program "steals" some RAM for its own use and this may upset certain other programs if they cannot work without this RAM.

This program is set in operation simply by typing for example "PRINT FILE.NAM<cr>", where "FILE.NAM" here is the name of some text file that you wish to print. Whilst printing proceeds, you have control of the computer returned to you and you can work (with some restrictions) with any other program. You must resist the natural temptation to simply gawp at the printer whilst it is printing, and discipline yourself to keep working at the keyboard. This is because operation of the PRINT.COM utility depends on the receipt of sufficiently frequent keyboard strokes by the user. (At each key stroke the program sends more data to the printer, so if you stop typing the printer will eventually run out of characters to print.)

SETB8SD.ASM

This is the source listing of a program which will be worth studying by all users. It demonstrates the manner in which the USER parts of the Interak CP/M BIOS may be modified to meet specific needs of the user. By way of example this program shows how a feature which will be of great usefulness to users with 8" disks can be added temporarily to the system. In such a system the program name means "Set Drive B to 8" Single Density". When this is done the system (which is normally double density) will treat drive B as being exclusively for standard Single Sided Single Density IBM format 8"

Disks. The system will remain so until the next cold boot. The benefit of this utility is that it allows to Interak user to read and write the universally standard 8" disks.

Users of other diameter disks can use this program as a model to produce some special system which is not provided on the menu of the CONFIG program, but which nevertheless they require for some special purpose, for example to read data from some other computer's diskettes having an "alien" format.

Although the SETB8SD.ASM program can be assembled and loaded using the ASM and LOAD programs respectively, it is not necessary to do this as it stands because the ".COM" file SETB8SD.COM already exists. The stepping rate of the drives in the given version is 6 ms, but this is easily altered by making a minor change to the appropriate equate statement at the beginning of the source file and reassembling and loading the program.

SETB8SD.COM

This is the ".COM" file referred to immediately above. Run it by typing SETB8SD<cr>. From then on, until the next cold boot (ie system reset), drive B will be set up to read and write standard 8" single sided single density IBM format diskettes (assuming you have the necessary 8" drive as drive B of course).

SPEEDTST.COM

This is a non-Digital Reasearch file. It is a utility which allows the user to find out for himself the effect of changing the skew factor when formatting diskettes for double density use in this system.

SKEW 2
21 SECS

Run the program by typing SPEEDTST<cr> and follow the instructions with the aid of a stopwatch. Transfer the program to a number of other disks, formatted with all the different skew factors you wish to try, and repeat the test. The use of the optimum skew factor will result in the shortest timing.

The program asks for the number of physical sectors per track which will be (for double density) 15 for 8" and 10 for the smaller sizes. It then asks for the number of CP/M sectors per physical sectors. As each physical sector is 512 bytes in our double density system, and each CP/M sector is 128 bytes, the answer to this question is 4.

Certain applications programs you may run in the future will make different use of the disk operating system, so to get a final optimisation then you should try carrying out some particular typical task of your own using disks formatted with slightly different skew factors from that so far determined, and choose the one which gives the best overall results for you. If you are in any doubt it is better to err on the larger side because a skew factor larger than optimum will slow the system down only a little, but a skew factor too small will slow the system considerably.

STAT.COM

This is the Digital Research program, exactly as supplied and

documented by them.

SUBMIT.COM

This is the Digital Research program, but with any published minor bugs fixed.

SYSGEN.COM

This is a modified version of the Digital Research Program. It is to be used in the same way as they describe in their documentation, but an additional way of invoking it is to type for example SYSGEN CPMXX.COM<cr>. This will cause the file CPMXX.COM (where XX is the size in kilobytes) to be loaded into the appropriate place in memory to be used in the next stage of SYSGEN which puts CPM on the system track of a disk you specify.

The main benefit of this version of SYSGEN is that it is equally suitable for all sizes of disk without alteration; it can be used with single sided or double sided double density disks, but note that it cannot be used with any single density disks.

The reason why it is suitable for both single sided and double sided disks is that in this implementation of CP/M the system is recorded on only one side of the disk on the systems tracks; regardless of whether or not the disk has the second side available. Although this wastes some of the useable area on a double sided disk the method keeps different disks as consistent as possible. The amount of space wasted is negligible as it is worth just a few pennies per disk.

USER.ASM

This is a listing (not from Digital Research) of the source code of all the parts of the Interak BIOS which can be modified by the advanced user, for example if he fits other items of hardware (VDUs, Serial Ports etc) which need their own particular driving routines. As all of the parameters relating to the disks are included here, the specialist user can use this listing to brew up any particular system which he requires, but which was not provided for in the options offered on the CONFIG menu when that program was run.

Most users will not want to make changes in this area, but the listing is provided for those who do. It will be particularly useful to experienced CP/M users who already have a collection of disks of their own which are not recorded to the same format as Interak but which they nevertheless wish to read in the Interak system.

XSUB.COM

This is the Digital Research program, exactly as supplied and documented by them.

Initial Installation

The following pages give a general discussion of what you should do when you receive your new Interak CP/M master disk. It is not possible for me to give a general step by step "This is what you do" sequence, since individual users' systems can be very different. However I have noted a clear tendency in our more enlightened users for them to follow closely my advice in choice of disk drive etc. After much careful consideration I have concluded that the best drives to use with an eye to the future are so called "1 Megabyte" (Double Sided, Double Density, 80 tracks per side) 3.5" diameter, and at least two should be used. As a reward to my faithful followers I can therefore include a step by step "This is what you do" guide in the form of Appendix A at the end of these notes. I almost choked on the last dictionary I swallowed so when I reach the end of these notes I will be using the minimum of words, hoping that you will have gained some feeling for the terms and techniques used by studying what follows immediately below.

1. If the package we send includes the original Digital Research Master Diskette (invariably 8", with their own printed label stuck on it) simply put this in a safe place as it is of no practical use to you. If you have a 5.25" or 3.5" system there will be no Digital Research Master Disk, because we cannot obtain the standard "raw" CP/M 80 on these smaller sizes.

2. Before you unwrap any of the items supplied, find and read the licence agreement from Digital Research regarding your obligations when using CP/M. If you do not find them acceptable you may return everything for a full refund, as long as it is in its original condition, the return is made within 7 days, and it is unused.

   Note that much of what is present on the Interak disk does not come from Digital Research. The copyright in the Interak BIOS and some of the utiltity programs is retained by Greenbank Electronics. For this we have not prepared a licence agreement couched in Draconian terms, since the authors of such documents seem to us to display paranoia bordering on the ridiculous. Nevertheless as publishers of software written by other authors we do act in every way possible to ensure that they are not cheated of their agreed royalties, and give this warning that we do not allow illegal copying of copyright material.

3. First set up an Interak System with at least 20K of RAM, at least a 64 column VDU, a Z80 (or equivalent) with a working DMON series disk boot/monitor, a keyboard, a floppy disk interface card and at least one floppy disk drive. Printer and tape interfaces are not necessary for what follows.

4. Examine the Interak CP/M Master disk and ensure that it is physically write protected (if this is possible). On an 8" disk this means that the "write-protect" notch must be uncovered. (If the disk has no such notch then it cannot easily be physically write protected, so ignore this part of these instructions.) On a 5.25" disk the notch must be covered to write protect the disk, and on a 3.5" disk the plastic write protect slide must be moved to uncover the write

protect aperture.

5. Switch on the computer, press reset on the CPU card, and confirm that there is a sign on message from the DMON boot/monitor program. Depending on the components and links on the floppy disk interface and the characteristics of the disk drives themselves, there may be some initial activity from the drives (eg if the drives have motor control, the motors may start running). Because the action at switch on is undefined it does not matter at this stage what activity you detect from the drives; I only mention that the motors may turn on so that you are not alarmed if they do.

6. Type "B<cr>" ("<cr>" means that the carriage return key is to be pressed; do not type the angle brackets and the letters "cr". The carriage return key is marked according to the whim of the keyboard manufacturer and can be marked "CR", "Ret", "Return", "Enter", or anything else. Many keyboards will also generate the required code if you type control-M, ie you hold the Control key down and type the letter M. Sometimes the control key is labelled "Alt", or something else - here we go again - but let us ignore these minor difficulties and return to the original subject of these notes.)

   The purpose of typing "B<cr>" is to start the "Boot" routine in the DMON monitor. For further details of the DMON monitor you should read the instructions for that product, but it is worth mentioning here that you do not have to enter any other commands before B for boot. The monitor works out for itself what type of disk drive is in use, whether it is double or single density, and will copy the first sector on the disk you insert in the A drive into an area of memory specified by the first byte of the sector and continue automatically as described in the DMON documentation.

7. Insert the Interak CP/M master diskette into the "A" disk drive. You should see some activity - the motor should be turning and the activity indicator light (if fitted and working) should be lit. If you have motor control and you have waited too long before inserting the diskette the motors may have stopped and nothing will happen. In this case press reset again on the CPU card, and type "B<cr>".

   (The reason I have for suggesting that inserting the diskette is the last thing you do reveals my great antiquity. In the early days of floppy disks users were advised never to mount a diskette in a drive which was stationary, for fear of damaging the central hole in the diskette as it was centred. Nowadays, with motor control, there is often no option but to mount the diskette in a stationary drive, so I cannot forbid it, but old habits die hard here. With the latest 3.5" drives there is certainly no worry on this score because the diskettes for these have a strong metal hub which it is nearly impossible to damage.)

   You should hear further activity from the disk drive as the CP/M loader does its work, and on the screen you should now see a sign on message from CP/M and a "directory" of the files on the diskette, which have been detailed elswhere in this document. To confirm CP/M is indeed in residence, and is able to receive commands, type

"DIR<cr>" on the keyboard and confirm that the directory is repeated. (You may type the command in upper case, "DIR", or lower case, "dir".)

At all stages there should be no particularly unpleasant noises from the disk drive mechanisms. If there are continuous ominous sounding mechanical noises which make you think something is wrong, do not proceed until you have found and rectified the fault, or sought expert advice (eg from me, he said modestly).

7. Type "FORMAT<cr>", and when you see its sign on message, remove the master disk from the A drive (merely as a precaution against destroying the data on the master disk, although this would require quite a sequence of disastrous mistakes). To be on the safe side however I shall say it again: when you see the sign on message, remove the master disk from the A drive. Insert a new diskette (or one with unwanted data) into the appropriate drive and answer the questions appropriately. See the description of the FORMAT program elswhere in this document for guidance on what is "appropriate". The aim at this stage is to format a disk with the same format as that supplied on the master disk, ie the same diameter, same number of tracks, and always single sided, double density, since this is how the master is supplied. It is permissable, indeed sensible, to cultivate as a habit with this system to format all disks as double sided (if you have double sided drives) even if they are to be used for the time being only as single sided.

8. Once the diskette is successfully formatted return the master to the A drive and exit from the FORMAT program by typing E for exit. The CP/M system prompt "A>" should appear again to show CP/M is ready for further commands from the keyboard.

9. Now type "COPYDISK<cr>" and copy the master disk (which you should think of as your "A" diskette for this purpose) on to the freshly formatted diskette (which you should think of for the time being as your "B" diskette, although the "A" drive will be used exclusively for what follows). Numerous exchanges of the diskettes will be necessary in the "A" drive order to complete this procedure, and you will be prompted whenever a change is required. Each time you change the diskette for this purpose you have to type <cr> (ie carriage return). Note that even if you have more than one disk drive all this work takes place on the "A" drive alone - have patience, you will soon be allowed to use the other drive(s). Anyway, the discipline of doing this kind of thing manually makes you appreciate just how much labour the use of suitable controlling software can save you, and will make you appreciate the work which CP/M is doing for you.

10. Once copying is complete, and you are back to the CP/M system prompt, remove the Interak CP/M master disk and put it in a place of safety. From now on do all your work with the copy you have made, which you should label appropriately.

11. The files on the master disk supplied may have been marked internally as "read only" for safety. In case this has been done convert them

all to "read write" status by typing "STAT *.* $R/W<cr>" (don't type the quotation marks or angle brackets). On the screen you should see each file named in turn as this action is carried out.

12. Type "CONFIG<cr>" and after reading the warning message (noting that you are using a copy, not the master) type "<cr>" again and answer the sequence of questions appropriately. This is reasonably straightforward if you know enough about your system to answer certain questions about its hardware configuration (if you are in any doubt, and cannot find the answer in any of the documentation I have sent, then ask me for guidance). If you have double sided disk drives, note that it is very easy to fall into a trap during this stage of the "CONFIG" procedure; I shall explain how and why in a few moments, so do read on.

If you make a mistake whilst using this program type "control-C" and begin again, or if you are in a real panic press CPU reset and reboot using the "B" command.

At the end of the question and answer session in the CONFIG program is another part which may cause difficulty. This is the part which asks for the sequence of bytes to move the cursor right non-destructively. If you are using your own terminal you will have to use whatever suits that, the information being given by the manufacturers or designers of the terminal. Note that your answers must be in decimal (eg answer "12" if the required code is "0C" in hexadecimal) followed by "<cr> and you finish by entering "0<cr>". If you do not know what suits your terminal but are impatient to proceed answer something else instead, eg "32", ie the code to print a blank space. In the majority of cases it hardly matter what you put because this code is only used in a single drive system, to place the messages "Mount Disk A" etc on the screen with the minimum of disturbance to any application program which may be in use.

If you are using a VDU-2K memory mapped screen you don't have the above worries since I shall tell you now what to answer: "12" followed by "0".

Now for the trap I mentioned into which double sided drive owners may fall. If you have two or more such drives, the temptation will be immense for you to select a double sided configuration for both A and B drives. Do not succumb to this temptation, but take a moment to think what it is you are doing. Remember the diskette in drive A is at present a single ~~density~~ sided diskette (it must be, because you have just made an exact copy of the original single sided diskette we supplied). It is therefore quite illegal at this stage for you to choose a double sided diskette configuration from the menu for the A drive: Just saying the diskette in drive A is double ~~density~~ sided doesn't make it so!

What you must do if you have double sided drives is begin by making a mixed system, ie drive A must be specified as single sided (so that it can read your one and only copy of the master disk) and only the other drive(s) (B,C,D) should be double density. Next (after formatting a double density diskette in drive B) the PIP utility must

be invoked along the lines which follow later in these notes, and all the files transferred from A to B undergoing as they travel a metamorphosis from the single sided format to the double sided format. Then CONFIG can be used again to produce a fully double sided system which can be put on the (double sided) B diskette (never on the single sided A diskette of course), and then the B diskette can be placed in the A drive and from then on, after pressing reset and rebooting, all drives can be double sided.

I am sorry it all sounds so complicated. If it does it is only because it is all so new. If we were talking of gramophone disks you would find it easy to understand that say a recording made at 45 rpm could not be played successfully at 33 rpm just by changing the title label on the disk (just saying it doesn't make it so!)

So to recapitulate, run the CONFIG program, answering all questions sensibly to suit your system but being certain to keep drive A specified as single sided for the time being.

13. Once you have the message "Configuration Completed" and the CP/M prompt back again, type "MOVCPM XX *<cr>". Note however that you do not type "XX" but a two digit decimal number representing the size of the system you require. For example, if you were feeling unadventurous you would type "MOVCPM 20 *<cr>" to leave the system set at 20K. If you have a serial system with a clean 64K of RAM you can type "MOVCPM 64 *<cr>", but if you have a VDU-2K, which prevents you using the upper 4K (hex. F000-FFFF) in the system, the biggest size of CP/M you can use is made by typing "MOVCPM 60 *<cr>".

14. After MOVCPM has done its job it invites you to "SAVE 40 CPMXX.COM" (where "XX" is again the size of the CP/M system you have specified). Do this. (ie Type "SAVE 40 CPMXX.COM<cr>" replacing "XX" with the size you have specified.)

15. There are other ways of proceeding (see the copious Digital Research documentation for this) but we suggest you now type "SYSGEN CPMXX.COM<cr>". After the message "Function Complete" you are asked for a "destination" drive. Answer "A<cr>", and after a few seconds of disk activity a further question will be asked. Although this question includes the phrase "return to re-boot" this option is not open to you if (as you have here) you have changed the operating parameters and/or size of the CP/M - the original system is no longer available on the A diskette to be re-booted. You must reset the CPU and use the DMON "B" command.

16. When you use the DMON "B" command this time, the system which should boot up is the one which you have configured for yourself. If you have specified two drives with identical formats you can make further exact copies of this whole "A" diskette by formatting another diskette in say the "B" drive (use "FORMAT") and then using the "COPYDISK" command to copy from A to B, but the more conventional way is to to use the procedure described next. If the system has been configured (by you, using the CONFIG program) for different formats of diskette (eg mixed single sided and double sided) then you must use the following procedure for transfers of files from one diskette

to another.

Making routine copies of CP/M and related files.

Your CP/M system is now ready for use, and you will have to study the Digital Research Documentation to become familiar with its operation. However, before we cast you out into the cruel hard world to fend for yourself here is one further procedure which you will need to know. This is the making of routine copies of CP/M and related files. The COPYDISK utility is one way of doing this but it destroys the contents of whatever was on the destination disk before. If you use COPYDISK and have copied files you did not really want then you can use the "ERA" command to erase the unwanted files.

The general method for making further CP/M disks which you can use is as follows:

1. If necessary, FORMAT the diskette which is to receive the copy. (Note that theoretically it is only necessary to format a disk once in its lifetime, since the format once written remains as written whatever normal use you make of the disk thereafter - eg "erasing" any or all of the files on a diskette does not erase the formatting information. Of course if a disk which has been used previously with only a single sided format is now required for a double sided format, then this is a case for a further FORMAT session.)

2. Make a copy of the (CP/M) system by using the SYSGEN program, answer the source question with "A", (since this is the drive which has the system disk which has been booted), and answer the destination question with whatever drive is to be used for the destination disk. You can put the system on one or more formatted disks, and when you have finished use <cr> to reboot.

3. Copy the files you want to copy by using the PIP program, as documented by Digital Research. (It is good practice to add "[OV]" at the end of a PIP command line - see the Digital Research documentation to learn what [OV] does). For example, to copy all the files from the "A" disk to the "B" disk, type "PIP B:=A:*.*[OV]" and <cr>. A message which is received by most users at some stage in their career is "DISK WRITE ERROR". Do not be alarmed at this - it does not mean that the computer is faulty. The explanation is that you have tried to copy more on to the destination disk than it has space to hold.

   You do not have to copy all the files unless you want to; consult the Digital Research description of the PIP utility for the various options you have.

Notice that under CP/M the diskette is divided into two different areas: The systems track or tracks which hold the CP/M system itself, and the rest, which are devoted to storing the users files, including any CP/M "transient" utility programs. The two areas are independent - you can

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have a disk full of files and programs but with no system present, and vice versa. In general it is compulsory only for the disk in the "A" drive must have the systems tracks recorded, but there is no objection to disks for the other drives having their own copy of the system as well. (Digital Research's licence agreement rather parsimoniously limits the maximum number of copies of your CP/M system you may possess at any one time to 5, but note that this is a legal restriction not a technical one.)

Installation of Applications Programs

With certain applications programs you may purchase, or obtain freely from the "public domain" there is an installation procedure to be followed. This procedure is usually required for those programs which make use of "on screen editing" in their operation, and which do this by sending cursor movement etc control characters directly to the terminal (VDU). This ruins the whole CP/M idea of the independence of programs from the hardware, because sadly different VDUs will require different control characters to perform the same action. If you feel this is spoiling the usefulness of CP/M where "any program will run on any machine" then this is a fair comment all you can do is refuse to use such badly behaved programs, but I for one would not want to deny myself such useful programs as Wordstar or dBase II because they need installing (altering) before they will give of their best. (A ready answer to those naive people who, confronted by the unwieldy infinity of differing formats, say "Why can't there be just one standard format we all can use?", is, yes there is a standard format, fixed for all time, 8" single sided single density 250K IBM 3740, but being human everyone is always striving for ever more data to be packed on ever smaller diskettes, and so breaking the standard.)

Installation of applications programs is generally quite straightforward, and simply involves entering as parameters into the program the various control codes and characteristics of your own particular VDU. I shall not have too much more to say on this here since this is a matter for the authors of the programs you want to use, and the designers of your VDU. However those of our users who are using the Interak VDU-2K card as their VDU will need me to say what they should do.

You will be relieved to learn that the Interak BIOS within this implementation of CP/M has the necessary routines already incorporated. A straw poll of a few applications programs, such as Wordstar and the like, showed that amongst the most common terminal codes in use are those of the ADM-3A VDU terminal (In the USA anyway.) Therefore the control codes for this terminal were adopted as the basis of those for the VDU-2K implementation. The full list is as follows (the ordinary ASCII control codes which all terminals would be expected to obey are also included in the list for completeness). The first column gives the codes in hexadecimal notation, the second in decimal:

Hex.	Decimal	Meaning
08	08	Back-space (Cursor Left)
09	09	Tab
0A	10	Line Feed

0B	11	Cursor Up
0C	12	Cursor Right
0D	13	Carriage Return (Cursor to beginning of line)
1A	26	Clear Screen
1B	27	ESC (Escape), see table below
1E	30	Cursor Home (top left of screen)

Escape Sequences

Sending the 4 byte sequence "ESC = <row> <col>", ie "ESC", "=", "<row>", "<col>" to the VDU-2K driver routine, moves the cursor to the specified row and column (the row and column must have an offset of 20 hexadecimal added to them). For example sending the following sequence 1B,3D,21,22 hexadecimal, (ie 27,61,33,34 decimal), would move the cursor to row 1 column 2 on the VDU-2K screen, since the hex. code "1B" is the code for "ESC", "3D" is the code for "=", "21" represents row 1 plus the offset of 20 hex., and "22" is column 2 plus the offset 20 hex.

The rows are numbered from 0 to 23 (or 24) starting from the top, and the columns are numbered from 0 to 63 starting from the left hand character in each row.

ESC 3, ie the sequence 1B,33 hexadecimal (27,51 decimal), turns Inverse Video on (ie characters thenceforth will be black on white).

ESC 4, ie the sequence 1B,34 hexadecimal (27,52 decimal), turns Inverse Video off (ie characters thenceforth will be white on black).

(The graphics characters in the character EPROM can be used, but must be written to the VDU-2K with bit 7 "on".)

Appendix 1: Installation Guide for Interak 3.5" CP/M

These are step by step instructions for a system using at least 2 of the Interak preferred standard 3.5" disk drives (80 track per side, double sided, double density). As explained elsewhere in these notes, the CP/M master diskette we supply is for the simplest possible system (1 drive, single sided, 20K RAM), and this appendix tells you what to do to configure it for a more sophisticated system.

1. Before you unwrap any of the items supplied, find and read the licence agreement from Digital Research regarding your obligations when using CP/M. If you do not find them acceptable you may return everything for a full refund, as long as it is in its original condition, the return is made within 7 days, and it is unused.

2. First set up an Interak System with at least 20K of RAM, at least a 64 column VDU, a Z80 (or equivalent) with a working DMON series disk boot/monitor, a keyboard, a floppy disk interface card and at least one floppy disk drive. Printer and tape interfaces are not necessary for what follows.

3. Examine the Interak CP/M Master disk and ensure that it is physically

write protected by moving if necessary the plastic write protect slide to uncover the write protect aperture.

4. Switch on the computer, press reset on the CPU card, and confirm that there is a sign on message from the DMON boot/monitor program. Do not worry if the drive motors begin to turn or not at this stage.

5. Type "B<cr>" ("<cr>" means that the carriage return (or "enter") key is to be pressed; do not type the angle brackets and the letters "cr".

6. Insert the Interak CP/M master diskette into the "A" disk drive. (It will fit only one way). You should see some activity - the motor should be turning and the activity indicator light should be lit. If you have motor control and you have waited too long before inserting the diskette the motors may have stopped and nothing will happen. In this case press reset again on the CPU card, and type "B<cr>".

   You should hear a few seconds of additional activity from the disk drive as the CP/M loader does its work, and on the screen you should now see a sign on message from CP/M and a "directory" of the files on the diskette, which have been detailed elswhere in this document. To confirm CP/M is indeed in residence, and is able to receive commands, type "DIR<cr>" on the keyboard and confirm that the directory is repeated. (You may type the command in upper case, "DIR", or lower case, "dir".)

7. Type "FORMAT<cr>", and when you see its sign on message, remove the master disk from the A drive (simply as a precaution). Insert a new diskette (or one with unwanted data) in any event one with the write protect aperture obscured, into the B drive and answer the questions appropriately, ie "B" drive, double sided, double density, start at track 0, finish at track 79, precompensation at track 43, skew factor 2.

8. Once the diskette is successfully formatted (160 asterisks displayed on the VDU screen) return the master to the A drive and exit from the FORMAT program by typing E for exit. The CP/M system prompt "A>" should appear again to show CP/M is ready for further commands from the keyboard.

9. Now type "COPYDISK<cr>" and copy the master disk (which you should think of as your "A" diskette for this purpose) on to the freshly formatted diskette (which you should think of for the time being as your "B" diskette, although the "A" drive will be used exclusively for what follows). Numerous exchanges of the diskettes will be necessary in the "A" drive order to complete this procedure, and you will be prompted whenever a change is required. Each time you change the diskette for this purpose you have to type <cr> (ie carriage return). Note that even if you have more than one disk drive all this work takes place on the "A" drive alone.

10. Once copying is complete, and you are back to the CP/M system prompt, remove the Interak CP/M master disk and put it in a place of safety. From now on do all your work with the copy you have made, which you

should label "First Copy of Interak Master CP/M" and the date.

10. Press reset, insert the copy disk into the A drive and type "B<cr>" (don't type the quotation marks or angle brackets).

10. Type "STAT *.* $R/W<cr>" . On the screen you should see each file named in turn as this action is carried out.

12. Type "CONFIG<cr>" and after reading the warning message (noting that you are using a copy, not the master) type "<cr>" again and answer the sequence of questions appropriately. If you make a mistake whilst using this program type "control-C" and begin again, or if you are in a real panic press CPU reset and reboot using the "B" command. An Interak with a VDU-2K card as VDU and a printer on Ports 02 and 03 hex will require the menu selections 3 for the type of VDU, and 2 for the type of printer. The number of drives question should be answered 2 if you have 2 drives, or more if you have more. The menu selection for the A drive should be 6 for single sided, followed by 1 to select the 3 ms stepping rate, and the B and subsequent drives should be specified as selection 7 (double sided) then 1 for 3 ms stepping rate. Finally for the cursor command question answer whatever is correct for your terminal, or "12<cr>0<cr>" if you are using the VDU-2K.

13. Once you have the message "Configuration Completed" and the CP/M prompt back again, type "MOVCPM 20 *<cr>" (This is for a 20K system; the size can be increased easily later.)

14. After MOVCPM has done its job it invites you to "SAVE 40 CPM20.COM" Do this by typing "SAVE 40 CPM20.COM<cr>".

15. Type "SYSGEN CPM20.COM<cr>". After the message "Function Complete" you are asked for a "destination" drive. Answer "A<cr>", and after a few seconds of disk activity a further question will be asked. Although this question includes the phrase "return to re-boot" this option is not open to you if (as you have here) you have changed the operating parameters of the CP/M - the original system is no longer available on the A diskette to be re-booted. You must reset the CPU and use the DMON "B" command.

16. Type "FORMAT<cr>", and when you see its sign on message insert a new diskette (or one with unwanted data), in any event one with the write protect aperture obscured, into the B drive and answer the questions appropriately, ie "B" drive, double sided, double density, start at track 0, finish at track 79, precompensation at track 43, skew factor 2.

16. Type "PIP B:=A:*.*[OV]<cr>" (do not type the quotation marks, and press return for <cr>).

    Copying will take place over the next few minutes, and a list of the files being copied will be presented on the screen.

12. Type "CONFIG<cr>", diregard the warning message (noting that you are using a copy, not the master) by typing "<cr>" again and answer the

sequence of questions appropriately. Answer the first few questions about the system as before, but this time select option 7 for both disk drives (ie double sided 80 track), stepping rate selection number 1 for the 3 ms rate. Finally answer the cursor command question as before, eg "12<cr>0<cr>" if you are using the VDU-2K.

13. Once you have the message "Configuration Completed" and the CP/M prompt back again, type "MOVCPM 20 *<cr>" (Keeping to 20K for the time being; the size can be increased easily later.)

14. After MOVCPM has done its job it invites you to "SAVE 40 CPM20.COM" Do this on the B drive by typing "SAVE 40 B:CPM20.COM<cr>". Do not forget the "B:"!

15. Type "SYSGEN B:CPM20.COM<cr>". After the message "Function Complete" you are asked for a "destination" drive. Answer "B<cr>", and after a few seconds of disk activity a further question will be asked. This question includes the phrase "return to re-boot" which you can do as the system on the A drive has not been changed and so can be re-booted.

16. Remove the diskette from drive B and label it as "Interak Installed 20K CP/M 2D" ("2D" = 2 sided, Double density), and the date. After it has been checked out keep this diskette as your working "master".

17. Reset the CPU, place this diskette in drive A, and type "B<cr>". The CP/M sign on message should be displayed, and a directory of files if you specified this should happen in the CONFIG dialogue.

16. Type "FORMAT<cr>", and when you see its sign on message insert a new diskette (or one with unwanted data), in any event one with the write protect aperture obscured, into the B drive and answer the questions appropriately, ie "B" drive, double sided, double density, start at track 0, finish at track 79, precompensation at track 43, skew factor 2.

    Copy all the files from A to B either by using the COPYDISK utility or PIP as before. I prefer PIP even though it takes longer, because the all important "Verify" parameter can be included.

    Now type "MOVCPM XX *<cr>", where this time "XX" is a figure you choose. "XX" in general is the maximum RAM size available for use in your system, for example "64" for a serial system with 64K of RAM available, "60" if a VDU-2K memory mapped screen is in residence at address F000 hex., and "48" if you only have 48K of RAM. (Many applications programs will not work with less than a 48K system, and a few insist on more.) If you have studied the Digital Research documentation you can use the invocation "MOVCPM * *<cr>" to produce a system which is as large as possible. Beware however of doing this if you have a memory mapped VDU (eg VDU-2K); the space occupied by the VDU will be detected by MOVCPM * * as being RAM for CP/M's use, which will precipitate a disaster when the first write access to the VDU-2K will write all over the RAM CP/M thought it had for itself!

14. After MOVCPM has done its job it invites you to "SAVE 40 CPMXX.COM".

You can do this if you wish, using either the A diskette or the B diskette as you prefer, but for the present purposes there is no need to carry out this save.

Now type "SYSGEN<cr>", and answer the first ("Source?") question with <cr>, because the system is now in memory as a consequence of the MOVCPM operation.

Answer "B<cr>" to the second ("Destination?") question, then <cr> to reboot.

Remove the diskette from the B drive and label it with details of its CP/M size, system hardware, and so on. This diskette will be the one you will want to make several copies of and use as your working CP/M. The data is easily copied using PIP or COPYFILE, and the system is copied using SYSGEN, usually answering "A<cr>" to the "Source?" question and "B<cr>" to the "Destination?" question. It is quite easy to get this wrong, so you may prefer to write protect one or more of your diskettes by moving the plastic slide to clear the write protect aperture. Individual files on a diskette can be rendered temporarily read-only (ie write protected) using "STAT FILE.NAM $R/O<cr>", where FILE.NAM can be just one file or an ambiguous file name referring to several or all files on the disk (see the Digital Research documentation for details of all these matters).

Press reset and boot up this diskette. Type "B<cr>" (with a double sided formatted diskette in the B drive), then "A<cr>". After doing this type "STAT DSK:<cr>" and check that the two tables presented on the screen are identical and that they give the expected capacities of the diskettes, ie around 700 kilobytes each. (Without the "B<cr>" above only the "A" table would have been presented.)

If you make fundamental changes to your hardware, eg convert from a memory mapped VDU to a serial terminal, or add more disk drives etc., you can use the CONFIG-MOVCPM-SYSGEN sequence as described above to reconfigure the CP/M system to suit your changed requirements. Wider variations than are allowed by the CONFIG menus are possible, but to achieve these you will have to enter the realm of assembly language programming and make your modifications after studying the "USER.ASM" listing.

D M Parkins